

## REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Claims 1, 10 and 17 are currently being amended. No new subject matter is being added. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending the claims as set forth above, claims 1-4, 6, 8-13, 15-20 and 22-23 are now pending in this application.

### **I. Claim rejections under 35 U.S.C. § 102**

On page 2 of the Office Action dated July 12, 2007, Claims 1-3, 6, 10, 15, 17-20 and 22 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,399,496 (Edelstein) as supported by U.S. Patent No. 6,749,699 (Bogel). The rejection was timely appealed and the Board affirmed the Examiner's rejection.

In the Office Action, the Examiner stated that:

Edelstein et al teach in figures 2 and 4 and related text a method of fabricating an integrated circuit, the method comprising:

depositing an etch stop layer 101 over a first conductive layer 46, wherein the etch stop layer is in direct contact with the first conductive layer;

depositing an insulator layer 54 after the etch stop layer is deposited over the etch stop layer;

forming a barrier layer 72 extending along lateral side walls and a bottom of a via aperture, the via aperture being configured to receive a via material that electrically connects the first conductive layer 46 and a second conductive layer 56; and

depositing a copper 76 alloy via material in the via aperture to form a via, the copper alloy material including Zinc (Zu) or Silver (Ag) and at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr) (column 8, lines 35-52).

Applicants respectfully traverse the rejection in view of the amendments and the arguments that follow.

Edelstein does not identically disclose, among other elements, a “depositing a copper alloy via material in the via aperture **on the barrier layer** to form a via, the copper alloy material including Zinc (Zn) or Silver (Ag) and at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr), **wherein the copper alloy via material completely fills the via aperture**” as recited in independent Claim 1, as amended.

Edelstein discloses depositing a seed layer 78 over barrier layer 72 in a via aperture followed by the deposition of a main conductor layer 82 that completely fills the aperture (column 7 lines 11-32, Fig. 3A-C). The copper alloys of the seed layer, which only line the aperture and do not fill it, include Ca, Cr, Ag and Zn (col. 8 lines 26-56). However, the main conductor layer that is deposited over the seed layer to fill the aperture does not utilize these elements in the formation of an alloy. Instead, Edelstein discloses a main conductor as “copper with an alloying-element such as C, N, O, Cl or S” (col. 7 line 65 to col. 8 line 6). This is not that same as “depositing a copper alloy via material in the via aperture **on the barrier layer** to form a via, the copper alloy material including Zinc (Zn) or Silver (Ag) and at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr), **wherein the copper alloy via material completely fills the via aperture**” as recited in claim 1 as amended.

Thus, Edelstein does not identically disclose depositing, on the barrier layer, a copper alloy via material made of Zn or Ag and Ca or Cr that completely fills the via aperture. Therefore, the rejection of Claim 1 over Edelstein is improper. Claim 1, as amended, is patentable over Edelstein.

Independent Claim 10 recites a “method of using ternary copper alloy to obtain a low resistance and large grain size interconnect or via,” comprising, among other elements, the step of “**filling the via aperture completely** with a ternary copper alloy via material to form a ternary copper alloy via **on the conformal layer**, the ternary copper alloy including at least one element for lowering resistivity and at least one of Chromium (Cr) or Calcium (Ca), wherein the ternary copper alloy via material includes an element with a characteristic for increasing grain size of the ternary copper alloy via.” Applicants respectfully submit that Edelstein does not disclose the method of Claim 10 for essentially the same reasons as provided with respect to independent Claim 1.

Independent Claim 17 recites a “method of forming a via in an integrated circuit,” comprising, among other elements, the step of “**filling the aperture completely** with a ternary copper alloy via material to form a ternary copper alloy via **on the barrier material**, the ternary copper alloy via including at least one of the following pairs of elements: Tin and Calcium; Tin and Chromium; Zinc and Chromium; Zinc and Calcium; Silver and Chromium; and Silver and Calcium, wherein the ternary copper alloy via material includes an element with a characteristic for increasing grain size of the ternary copper alloy via.” Applicants respectfully submit that Edelstein does not disclose the method of Claim 17 for essentially the same reasons as provided with respect to independent Claim 1.

Dependent Claims 2-3 and 6, which depend from independent Claim 1, are also patentable for at least the same reasons as claim 1. Dependent Claim 15, which depends from independent Claim 10, is also patentable for at least the same reasons as claim 10. Dependent Claims 18-20 and 22, which depend from independent Claim 17, are also patentable for at least the same reasons as claim 17.

Accordingly, Applicants respectfully request withdrawal of the rejection of Claims 1-3, 6, 10, 15, 17-20 and 22 under 35 U.S.C. § 102(e).

## **II. Claim Rejections under 35 U.S.C. § 103**

On page 4 of the Office Action dated July 7, 2007, claims 8, 13 and 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Edelstein in view of Bogel. The rejection was timely appealed and the Board affirmed the Examiner's rejection.

On page 4 of the Office Action dated July 7, 2007, claim 4 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Edelstein and Bogel in view of U.S. Patent No. 6,440,849 (Merchant). The rejection was timely appealed and the Board affirmed the Examiner's rejection.

On page 5 of the Office Action dated July 7, 2007, claims 9 and 23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Edelstein and Bogel in view of U.S. Patent No. 6,380,083 (Gross). The rejection was timely appealed and the Board affirmed the Examiner's rejection.

On page 5 of the Office Action dated July 7, 2007, claims 11 and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Edelstein and Bogel in view of U.S. Patent No. 6,090,710 (Andricacos). The rejection was timely appealed and the Board affirmed the Examiner's rejection.

Dependent claims 4 and 8-9 depend from independent claim 1 and are allowable for at least the same reasons as claim 1 as provided above.

Dependent claims 11-13 and 16 depend from independent claim 10 and are allowable for at least the same reasons as claim 10 as provided above.

Dependent claim 23 depends from independent claim 17 and is allowable for at least the same reasons as claim 17 as provided above.

Accordingly, the Applicants request withdrawal of the rejections of the Claims 4, 8-9, 11-13, 16 and 23 under 35 U.S.C. § 103(a).

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Applicants believe that the present application is now in condition for allowance.  
Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a  
telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be  
required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to  
Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by the credit  
card payment instructions in EFS-Web being incorrect or absent, resulting in a rejected or  
incorrect credit card transaction, the Commissioner is authorized to charge the unpaid amount to  
Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of  
papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136  
and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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